



# Healthcare Analytics in Navy Medicine

## *Perspectives and Methods for Decision-Making*

### FOCUS ON HIGH RELIABILITY ORGANIZATIONS (HROs)

#### High-Reliability—A Quality Improvement Journey

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High-reliability in health care means zero preventable harm to patients, which is a continuing goal of many health care organizations, including the Military Health System (MHS). High Reliability Organizations (HROs) are organizations with systems in place that are exceptionally consistent in accomplishing their goals and avoiding potentially catastrophic errors.<sup>1</sup> In an effort to transform the MHS, the Services and Defense Health Agency (DHA) have developed action plans to advance safety, quality, and access and transition the MHS to an HRO. However, progress from low- to high-reliability is an ongoing journey that requires long-term commitment and adaptability at all levels of an organization. This article describes the need for highly reliable health care and summarizes key guiding principles necessary to achieve HRO status.

The problem of “preventable harm” has been documented for decades. It has now been over fifteen years since the well-known and often-cited Institute Of Medicine (IOM) report, “To Err is Human”, was released in November of 1999.<sup>2</sup> This report cited two studies indicating that the rate of patient deaths due to medical errors was between 44,000 and 98,000 per year in the U.S. A decade and a half later, Pronovost and colleagues reflected on the 1999 IOM report, stating that “progress towards reducing this harm has proven difficult because health care lacks robust mechanisms to routinely measure the problem and estimates of the magnitude vary widely.”<sup>3</sup>

Chassin and Loeb of The Joint Commission, reported a sobering truth in the *Milbank Quarterly* saying that “no hospitals or health systems have achieved consistent excellence throughout their institutions.”<sup>4</sup> They define

high-reliability science as “the study of organizations in industries like commercial aviation and nuclear power that operate under hazardous conditions while maintaining safety levels that are far better than those of health care.” Chassin and Loeb propose that the successes of other high-risk industries in achieving high-reliability can offer lessons to health care systems, and, with certain adaptations, can pave the way for hospitals to reach a similarly high rate of quality and safety.

Several factors have been found to be key when examining what makes an organization “highly reliable.” In *Managing the Unexpected*, Weick and Sutcliffe describe the importance of “collective mindfulness,” the idea that all employees are committed to identifying and reporting “small problems or unsafe conditions” prior to their escalating to a point which would make them difficult to address.<sup>5</sup> Organizations that foster collective mindfulness, in which identification of errors is prized and used as an opportunity to learn and grow, rarely experience serious accidents.

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*The content of this publication does not represent the official view of the US Navy Bureau of Medicine and Surgery, the United States Navy, the United States Department of Defense or the United States Government.*

1 Hines S., Luna, K., Lofthus J., et al., “Becoming a High Reliability Organization: Operational Advice for Hospital Leaders,” Agency for Healthcare Research and Quality Publication No. 08-0022, Rockville, MD, April 2008.

2 Institute of Medicine (IOM), “To err is human: Building a safer health system,” November, 1999.

3 Pronovost, P. J., Cleeman, J.I., Wright, D., Srinivasan, A., “Fifteen Years After To Err is Human: A Success Story to Learn From,” *BMJ Qual Saf*, Vols. doi:10.1136/bmjqs-2015-004720, 2015.

4 Chassin, M.R., Loeb, J.M. “High Reliability Health Care: Getting There From Here” *The Milbank Quarterly*, Vol. 91, no. 3, p.459–90, 2013.

5 Weick, K.E., Sutcliffe, K.M., *Managing the Unexpected: Resilient Performance in the Age of Uncertainty*, San Francisco, CA: Jossey-Bass, 2007.



Johns Hopkins University recently released the results of a study concluding that over 200,000 deaths per year in the U.S. are due to medical error, making it the third leading cause of death after heart disease and cancer.<sup>6</sup> The authors emphasize the fact that the majority of these medical errors are the result of systemic problems, such as poorly coordinated care, disjointed insurance networks, and lack of safety protocols.

*Managing the Unexpected* identifies five principles that provide a roadmap to achieving and maintaining a “high-reliability organization” (HRO) as stated below.<sup>4</sup> These principals are also cited by the Agency for Healthcare Research and Quality (AHRQ).<sup>1</sup>

- **Preoccupation with Failure** - HROs never become complacent, even when they have not experienced an accident for long stretches of time. They remain alert to signals, however small, that safety issues may be developing. Weick and Sutcliffe acknowledge that this can be difficult, citing one operator who said, “If every day we have to assume that we’ve missed something, then it is a real struggle to think that way.”
- **Reluctance to Simplify** - HRO staff demonstrate an ability and commitment to identifying the details of potential hazards, rather than simplifying their observations. Weick and Sutcliffe suggest that demanding attention to the complex nature of potential threats creates an environment of healthy skepticism. For example, when a reviewer makes an independent effort to confirm or refute a report, there are now two observations where there was originally only one.
- **Sensitivity to Operations** - HROs understand that often, the first signs of a lapse in safety or quality can be found at the operational level. Therefore, HROs are committed to supporting those workers most aligned with operations to systematically report any “deviations from expected performance.” HROs embrace the voicing of everyone’s concerns, as a path toward achieving exemplary levels of safety.
- **Resilience** - Even the highest-functioning HROs will experience set-backs and threats to safety. A resilient organization quickly recognizes errors and contains them, ensuring that problems do not burgeon out of control and become far more difficult to ameliorate.

Weick and Sutcliffe describe life in an HRO as a constant diet of interruptions and recoveries. Interruption is about stretching without breaking. Recovering is about bouncing back from that stretch to something akin to what existed prior to the interruption. Resilience is important to both of them.

- **Deference to Expertise** - HROs are equipped to identify and call upon those individuals most qualified to manage each specific threat identified. Rather than relying on rank or seniority, HROs recognize the importance of giving authority and decision-making power to the individuals or groups with the most relevant experience.

AHRQ reports that these high-reliability concepts are tools that a growing number of hospitals are using to help achieve their safety, quality, and efficiency goals.<sup>1</sup> Creating a culture and processes that radically reduce system failures and effectively responding when failures do occur is the goal of high-reliability thinking.

This complex journey toward high-reliability continues. Recently, Senator Sheldon Whitehouse introduced S.2467 - Patient Safety Improvement Act of 2016 to “reduce health care-associated infections and improve antibiotic stewardship through enhanced data collection and reporting, the implementation of State-based quality improvement efforts, and improvements in provider education in patient safety.”<sup>7</sup> When introducing his legislation, Senator Whitehouse captured the concept of a journey to high-reliability in health care, saying, “There are many different ways to tackle these challenges. I view this legislation as a starting point, and I welcome your feedback on what needs to be done to eliminate health care-acquired infections. Please consider me your ally in reaching zero preventable hospital deaths by the year 2020”.<sup>8</sup>

At the High Reliability Health Care Summit earlier this year, Navy Vice Admiral Raquel Bono, DHA director, acknowledged the MHS’s own journey toward high-reliability. She discussed MHS’s commitment in 2014 to “set a goal to figure out what was keeping military hospitals

6 Makary, M.A., Daniel, M., “Medical error- the third leading cause of death in the US,” *BMJ*, vol. 353, no. 2, p. 139, 2016.

7 “S. 2467: Patient Safety Improvement Act of 2016,” Jan 27 2016. [Online]. Available: <https://www.govtrack.us/congress/bills/114/s2467>. [Accessed 18 May 2016].

8 Business Wire, “Patient Safety Movement Foundation applauds introduction of the Patient Safety Improvement Act of 2016,” February 1, 2016. [Online]. Available: <http://www.businesswire.com/news/home/20160201006442/en/Patient-Safety-Movement-Foundation-App>. [Accessed 17 May 2016].



and clinics from performing at the level they should... to look at ourselves and what [we could] say about ourselves in terms of access, quality, and safety.”<sup>9</sup> She closed by saying “I would consider us in the very early stages of this journey. But, I would ask you to keep an eye on us, because I think we’re starting to make some of the progress that initially was very difficult to do.”

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## SKILLS AND METHODS

### — APPLYING THE FRACTAL MODEL TO HEALTH CARE QUALITY IMPROVEMENT EFFORTS

Aspirations for high-reliability in health care are grounded in a patient-centric view of quality and safety. While safety and quality leaders nationwide have called for system approaches to improve care, research by Pronovost and Marsteller at Johns Hopkins has found few organizations with the infrastructure in place to support such an approach.<sup>10</sup> The most effective model they have seen is one in which clinicians’ “commitment to patient safety, [quality improvement] and patient-centeredness” serves as the catalyst for committing the resources and support needed to implement systemic change. Pronovost and Marsteller state that “healthcare organizations need a structure that generates a chain of accountability to improve safety, defining accountable staff at each level of the organization while encouraging innovation in how to improve.” Such multi-level efforts require more improved coordination than has been seen to date. Where can health care leaders turn for solutions to the problem of increasing the level of coordination in multi-level systems?

## The Fractal Model

Many structures observed in nature can be modelled using what are known as fractal representations. Mathematician Benoit Mandelbrot, cited by Pronovost and Marsteller in their work, explains that ferns are an example of a fractal because “...the whole object has the same shape as one or more of its parts, and all of the parts are connected to support and shape the larger structure in which it resides.”<sup>11</sup> More generally, fractals are structures composed of self-similar patterns, in which the structure, taken as a whole, is comprised of smaller structural components with a similar shape and design. If the social fabric of an organization such as Navy Medicine has a culture of shared values represented at all levels of the organization, it exhibits some aspects of this fractal concept.



Pronovost and Marsteller suggest that “studying nature and applying its inherent designs and processes to solve human problems” may have applicability for modeling health care systems.<sup>10</sup> They propose that health care systems apply the fractal model to “accelerate improvements in safety with a quality infrastructure with such repeating patterns.” In this case, the fractal approach consists of “a repeating structure for building and supporting quality improvement expertise, goal alignment, and communication.” There are several core elements to the fractal model when applied to health care systems.<sup>10</sup> They include:

- A foundational “root” system comprised of interdisciplinary experts in improvement to provide structure and serve as a resource
- Training and support for health care team member professionals involved at each system level in quality improvement
- Universal goals that are clearly defined, and “aligned with standard measurement, transparent reporting, and assigned accountability”
- Structures that enable horizontal peer learning “across entities at the same level”
- Inclusion of representatives from the patient population to inform meaningful quality improvement within the structure

<sup>9</sup> “Bono: High Reliability a Continuing Goal of the Military Health System,” [Online]. Available: <http://health.mil/News/Articles/2016/02/25/Bono-High-reliability-a-continuing-goal-of-Military-Health-System>. [Accessed 18 May 2016].

<sup>10</sup> Pronovost, P.J., & Marsteller, J.A., “Creating a fractal-based quality management infrastructure. *Journal of Health Organization and Management*,” *Journal of Health Organization and Management*, vol. 28, no. 4, pp. 576-586, 2014.

<sup>11</sup> Mandelbrot, B. *The Fractalist: Memoir of a Scientific Maverick*, New York, NY: Pantheon Books, 2012.





## Comprehensive Unit-Based Safety Program (CUSP)

Extending the fern analogy, at the end of the frond, the system “touches the patient.” Pronovost and Marsteller explain the importance of having in place teams of “frontline implementers” at this point in the structure.<sup>10</sup> An application of the fractal model in health care is the Comprehensive Unit-based Safety Program (CUSP), an “interprofessional, local, team-based method to improve teamwork, communication, and patient safety.”<sup>12,13</sup> The CUSP program is a five-step patient safety framework that Johns Hopkins Health System has been utilizing since the early 2000s. The primary goal of this program is to empower staff to take responsibility of safety in their units while changing the unit’s workplace culture. CUSP has proven to be a sustainable and successful patient safety framework by targeting effort at the unit level with the support of the organization as a whole.<sup>12</sup> Clinical communities using CUSP serve as horizontal peer-learning structures at all three levels (facility, region, and enterprise-wide) of the health care system.

The fractal model has repeatedly proven to be beneficial at health system, state, and even country-wide quality improvement efforts. The authors cite the CUSP program’s marked success within the Johns Hopkins Health System, which was able to achieve a 96 percent-plus compliance rating on “core process measures” and which received the National Leader Top Performer Award from The Joint Commission.<sup>10, 14</sup>

The Johns Hopkins journey using a fractal model for quality improvement and patient safety in several projects involving multi-level organizations has been extremely positive. When the fractal model’s characteristics are present throughout a health care organization, workers are inspired by common goals; all hospital levels are linked and are able to support learning and accountability; solutions are anchored in local wisdom; patient perspectives are valued, sought out and incorporated; and resources are allocated to effect positive change.

12 Pronovost, P., Weast, B., Rosenstein, B., Sexton, J.B., Holzmüller, C.G., Paine, L., Davis, R., and Rubin, H.R. “Implementing and validating a comprehensive unit-based safety program,” *Journal of Patient Safety*, vol. 1, no. 1, pp. 33-40, 2005.

13 Timmel, J., Kent, P.S., Holzmüller, C.G., Paine, L.A., Schulick, R.D., & Pronovost, P.J., “Impact of the comprehensive unit-based safety program (CUSP) on safety culture in a surgical inpatient unit,” *Joint Commission Journal on Quality and Patient*, 2010.

14 Pronovost, P.J., Demski, R., Callender, T., Winner, L., Miller, M.R., Austin, J.M., & Berenholtz, S.M., “National Leadership Core Measures Work Groups. Demonstrating high reliability on accountability measures at the Johns Hopkins hospital,” *Joint Commission Journal on Quality and Patient Safety*, vol. 39, no. 12, pp. 531-544, 2013.

## DATA AND INFORMATION SYSTEMS

### – JOINT COMMISSION CENTER FOR TRANSFORMING HEALTHCARE

This article provides an overview of the information and resources available through the Joint Commission Center for Transforming Healthcare website. The Center’s mission is to transform health care into a high-reliability industry, in which every patient receives excellent care, every time.

### About the Joint Commission Center for Transforming Healthcare

Created in 2008, the Joint Commission Center for Transforming Healthcare aims to solve health care’s most critical safety and quality problems. The Center’s participants—some of the nation’s leading hospitals and health systems – use a systematic approach to analyze specific breakdowns in care and discover their underlying causes to develop targeted solutions that solve these complex problems. In keeping with its objective to transform health care into a high-reliability industry, The Joint Commission shares these proven effective solutions through the Center’s website with the nearly 21,000 health care organizations it accredits and certifies. This web resource includes an overview of the high-reliability concept, information about the Center’s key and targeted high-reliability initiatives, video presentations, podcasts, a resource library, and education and training opportunities.

### High-Reliability Initiatives

One of the Center’s key high-reliability initiatives includes Oro™ 2.0, an online organizational assessment designed to guide hospital leadership throughout the high-reliability journey. This assessment helps organizations identify their high-reliability maturity level and opportunities for improvement in the areas of leadership commitment, safety culture, and performance improvement. Organizations participating in Oro™ 2.0 receive a detailed summary report and specific resources to help further the organization’s maturity level. Currently, Oro™ 2.0 assessments at four Military Treatment Facility (MTF) sites, one in each Service and at the National Capital Region (NCR) Medical Directorate, are underway to determine the facilities’ maturity in adoption of practices that lead to high-reliability.



The Center's high-reliability efforts also include targeted initiatives such as: hand hygiene, hand-off communications, preventing avoidable heart failure hospitalizations, preventing falls, reducing sepsis mortality, safe and effective use of insulin, safety culture, surgical safety, and preventing venous thromboembolism. Related to these targeted initiatives, the Center has developed a series of Targeted Solutions Tools (TST)<sup>®</sup>, which provide step-by-step processes to accurately measure an organization's actual performance, identify barriers to excellent performance, and direct the organization to proven and customized solutions to address particular barriers to high-reliability performance. Detailed information about each TST<sup>®</sup> can also be found on the website.

### Education and Training

The Center for Transforming Healthcare also provides education and training opportunities that range from day-long orientations to multi-year, in-depth courses and certifications. Most training opportunities also provide Continuing Education (CE) credits. The Center also hosts workshops and webinars on specific topics and announces these offerings through their website.

Additional information about the Joint Commission's Center for Transforming Healthcare and its resources for organizations and change leaders can be found at <http://www.centerfortransforminghealthcare.org/>.

## NEW KNOWLEDGE

### – NOTED PUBLICATIONS

The Memorial Hermann Health System (MHHS) in Houston is comprised of over 200 ambulatory care organizations, specialty programs, and services serving the greater metropolitan area. MHHS employs more than 24,000 staff and 5,000 physicians. A recent article discusses in detail how their hand hygiene initiative to make MHHS a high-reliability organization has made impressive strides toward reaching this goal. Below, we provide a brief summary of some of the article's key points.

#### **Using the Targeted Solutions Tool<sup>®</sup> to improve hand hygiene compliance is associated with decreased health care-associated infections.**

Shabot MM, Chassin MR, France AC, Inurria J, Kendrick, J, and Schmaltz SP. *Jt Comm J Qual Saf.* 2016 Jan; 42(1): 6-17.

In 2006 Memorial Hermann Health System (MHHS) in Houston implemented a comprehensive, system-wide initiative to improve hand hygiene, with the ultimate goal being zero harm for patients and members of the healthcare team. As part of this effort, MHHS aimed to eliminate health care-associated infections (HAI) and saw hand hygiene as an important contributor to that HRO strategy. MHHS team members acknowledged that although studies have demonstrated that improving hand hygiene in hospitals reduces rates of infection, spreading and sustaining improved compliance had proven to be difficult. Their initiative methods included:

- The systematic identification of effective and reliable strategies for collecting hand hygiene compliance data
- Determination of the root causes and contributing factors for non-compliance
- Implementation of specific interventions to address each factor

MHHS utilized the Joint Commission Center for Transforming Healthcare's Targeted Solutions Tool (TST)<sup>®</sup> methodology and web-based application, implementing the TST<sup>®</sup> for hand hygiene in 150 inpatient units as part of a plan-do-check-act (PDCA) approach in 12 hospitals. The tool enabled MHHS teams to measure compliance rates, identify reasons for non-compliance, implement tested interventions provided by the tool, and sustain the improvements. Data on rates of ICU central line-associated bloodstream infections (CLABSIs) and ventilator-associated pneumonia (VAP) were also collected and observed over the course of the project.

The MHHS hand hygiene initiative was also led by an expert in Robust Process Improvement (RPI)<sup>®</sup> methodology, who was a "Master Black Belt (MBB)" in quality, patient safety, and infection control. At each hospital in the system, the chief nursing officer served as executive sponsor and was responsible for identifying process owners at both the facility and unit levels. Most of the process owners primarily held nursing leadership positions; others held respiratory therapy and infection control positions.

The article reported that based upon 31,600 observations during the 6-month baselining period, MHHS system-wide hand hygiene compliance averaged over 58 percent. The "improve" phase over an 18-month period drove compliance up to over 80 percent. The control phase, which lasted over two years, saw an additional 15 percent



increase, reaching a compliance rate of over 95 percent in the final 12 months. The MHHS Team also saw adult ICU CLABSI and VAP rates reduced by 49 percent and 45 percent, respectively. Data from this study enabled MHHS to conclude that procedure-specific processes to reduce infections related to devices such as central lines, ventilators, or urinary catheters may not, in fact, achieve extremely low rates of infection unless they are accompanied by high rates of hand hygiene compliance.

MHHS has substantially improved hand hygiene compliance and has “sustained the gain” of high levels of compliance for the 25 months since implementation. The authors attribute the system-wide advances in quality and patient safety to several critical success factors:

- There was leadership support and oversight across the system that enabled allocation of the necessary resources.
- There was commitment of the MBB with expertise in applying the Joint Commission’s RPI®.
- The organization focused on the early steps of the TST® process, which showed staff the “value of accurate and robust data collection”, rather than rushing through these early phases in order to skip to the improvement implementation stage. By carefully implementing the first steps of the TST®, root causes of problems could be addressed so they would not recur.
- Use of the TST® tool provided guidance on how to “collect, input, and analyze reliable data provided by secret observers.” Doing so showed that previous estimates of MHHS compliance rates had been significantly inflated. Getting more accurate compliance rates and then implementing “proven solutions targeted at the respective unit-level factors”, rather than using a one-size-fits all strategy, enhanced both the program’s effectiveness and its sustainability.

The full article can be found at [https://www.jointcommission.org/assets/1/18/JQPS0116\\_01\\_Shabet.pdf](https://www.jointcommission.org/assets/1/18/JQPS0116_01_Shabet.pdf).

## KNOWLEDGE SOURCES

### — PUBLICATIONS RESOURCES

The following publications are recommended reading for those who wish to broaden their capabilities by acquiring a foundational understanding of current topics and issues in health system change and improvement.

#### Health Systems Management Research

*Health Services Management Research (HSMR)* is an international peer-reviewed journal which publishes research on questions of enduring interest to health care organizations and systems throughout the world. Examining the real issues confronting health services management, it provides an independent view and evidence-based research to guide policy-making and management decision-making. HSMR target audience includes academic researchers, healthcare managers, executives, policy-makers and clinicians, and all health professionals. More information about this publication can be found at <http://journals.lww.com/greenjournal/pages/default.aspx>.

#### The Joint Commission Journal on Quality and Patient Safety

Published monthly, *The Joint Commission Journal on Quality and Patient Safety* is a peer-reviewed publication dedicated to providing health professionals with the information they need to promote the quality and safety of health care. This publication includes original manuscripts on the development, adaptation, and/or implementation of innovative thinking, strategies, and practices in improving quality and safety in health care. Case studies, program or project reports, reports of new methodologies or new applications of methodologies, research studies on the effectiveness of improvement interventions, and commentaries on issues and practices are also highlighted. More information about this publication can be found at <http://www.jcrinc.com/the-joint-commission-journal-on-quality-and-patient-safety/>.

#### BMJ Quality & Safety

*BMJ Quality & Safety* (previously *Quality & Safety in Health Care*) is an international peer review publication providing research, opinions, debates, and reviews for academics, clinicians, and health care managers focused on the quality and safety of health care and the science of improvement. The journal integrates the academic and clinical aspects of quality and safety in health care



by encouraging academics to create evidence and knowledge valued by clinicians and clinicians to value using evidence and knowledge to improve quality.

Many of the journal's Online First and current issue articles are open access and available without a journal subscription. Moreover, the journal organizes articles by topics at <http://qualitysafety.bmj.com/collections>. For example, a drill down menu under "Non-clinical" and "Healthcare improvement and patient safety" displays topics such as change management, high reliability, and quality improvement.

Additionally, the journal recently began posting free podcasts on a variety of quality and safety topics. This "Making a Difference" Podcast series can be accessed from the journal's main webpage or directly at <https://soundcloud.com/bmjpodcasts/sets/making-the-difference>.

More information about this publication can be found at <http://qualitysafety.bmj.com/>.

## IN THE NEXT ISSUE

The next issue of *Healthcare Analytics in Navy Medicine* will focus on MHS pharmacy operations. This issue will provide an overview of current pharmacy topics and issues faced by multiple MHS organizations, how to analyze and monitor pharmacy use, and how pharmacy data are reported. Moreover, non-MHS resources to assess drug approvals and patent information will also be highlighted.

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